Annual Report 2001 of IGS RNAAC SIR

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Introduction

Since more than six years DGFI is acting as the IGS RNAAC SIR, and provides the weekly coordinate solutions in SINEX format of permanently observing GPS stations in South America and the surrounding area to the IGS global data centers (Seemüller and Drewes, 1997, 1998, 1999, 2000). By using the automated Bernese Processing Engine of the Bernese GPS Software (Rothacher et al., 1996, Hugentobler et al., 2001) all available data in this region are routinely processed on a weekly basis.

Station Network

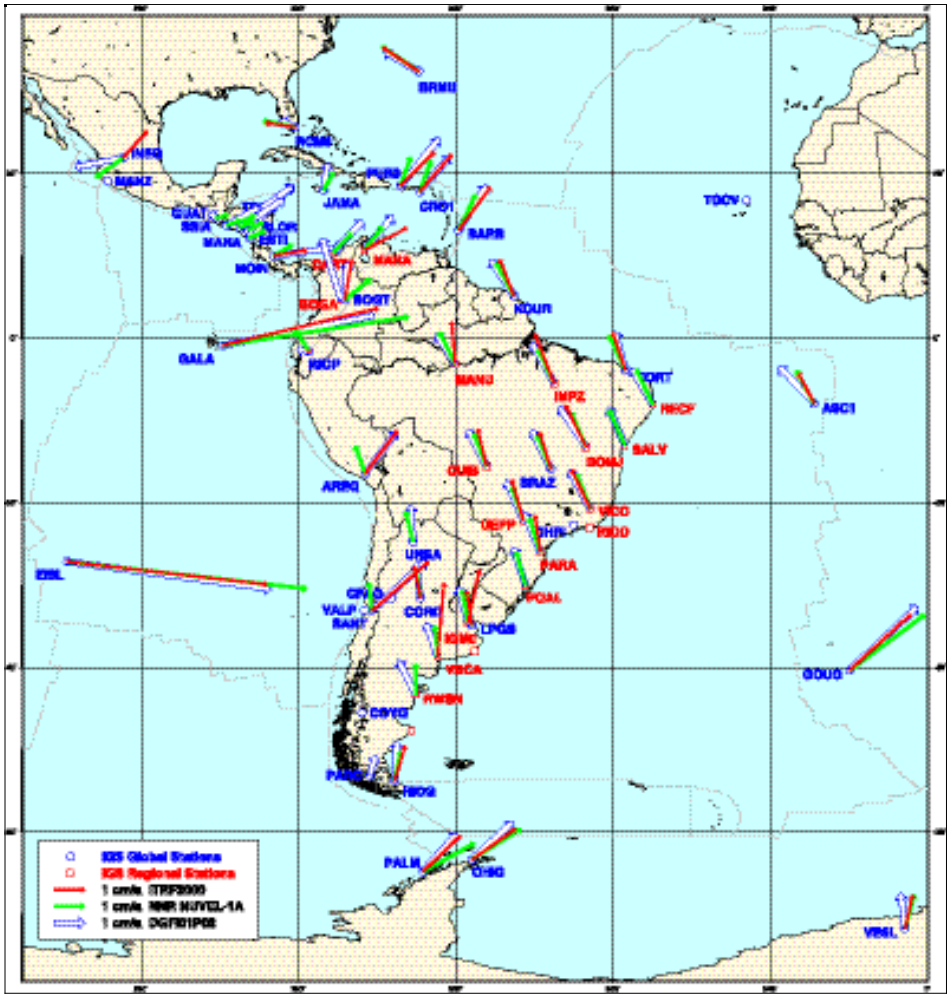

Figure 1: IGS RNAAC SIR network and horizontal velocities of solution DGFI01P02 compared with ITRF2000 and NNR NUVEL-1A

The RNAAC SIR network is continously densified by new stations. In 2001, stations were installed in Caucete (CFAG) in Argentina, Manzanillo (MANZ) in Mexico, Cachoeira (CHPI) in Brazil, Punta Arenas (PARC), Coyhaique (COYQ) and Valparaiso (VALP) in Chile, and Cape Verde (TGCV). The stations CHPI, TGCV, COYQ and VALP haven't delivered data until end of 2001. A new regional GPS station Rio de Janeiro (RIOD) in Brazil was added to the net. End of 2001 the RNAAC SIR network consists of 55 stations, 38 are global and 17 are regional stations (Figure 1).

Solutions

The processing strategy was slightly modified in 2001. The elevation cutoff angle was set to 10 degrees, and since December 2001 (GPS week 1144) the version 4.2 of the Bernese GPS software is used.

In 2001 two new solutions for coordinates and velocities were generated. The second solution (figure 1), was presented at the IAG General Meeting, August 2001, in Budapest. The contribution of the RNAAC SIR stations to this solution is given in figure 2.

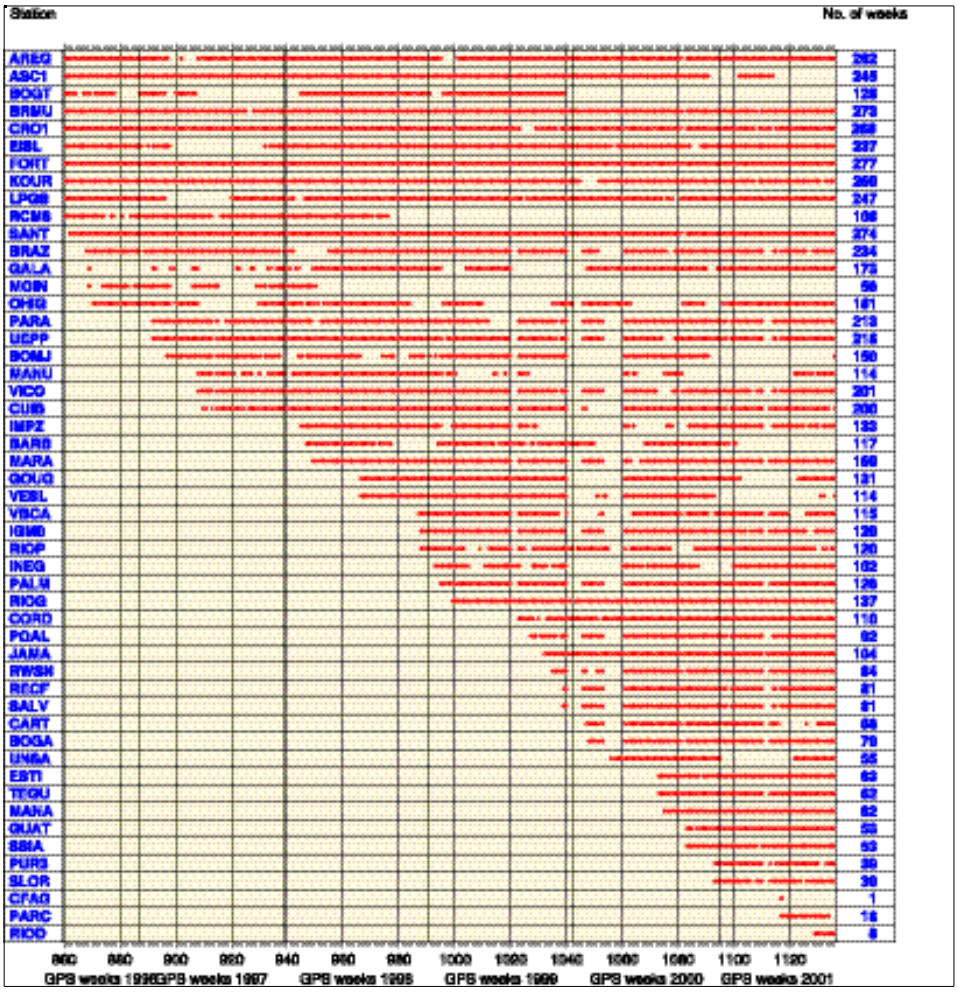

Figure 2: Weekly contribution of RNAAC SIR stations to solution DGFI01P02

DGFI01P02 is a regional solution, it covers the time period from June 30, 1996 to October 20, 2001, and provides positions and linear velocity estimates of 49 sites being in operation since at least one year. The solution is based on weekly SINEX files generated by the IGS RNAAC SIR. IGS combined orbits and earth orientation parameters were held fixed. The solution is referred to ITRF2000 by introducing positions at the reference epoch (1998, day 119) and velocities of AREQ, CRO1, FORT and SANT as fictitious observations. The weight applied to these "observations" is set such as to still allow the positions and velocities of these fiducial stations to deviate from their ITRF2000 values by some mm and 0.1 mm/year per year, respectively.

In the region of the South American reference system 1481 earthquakes occured with a magnitude > 5, including 20 with a magnitude > 7, in the period from June 30, 1996 to end of 2001 (Figure 3). All the coordinate time series of stations close to these earthquakes were checked for eventual effects.

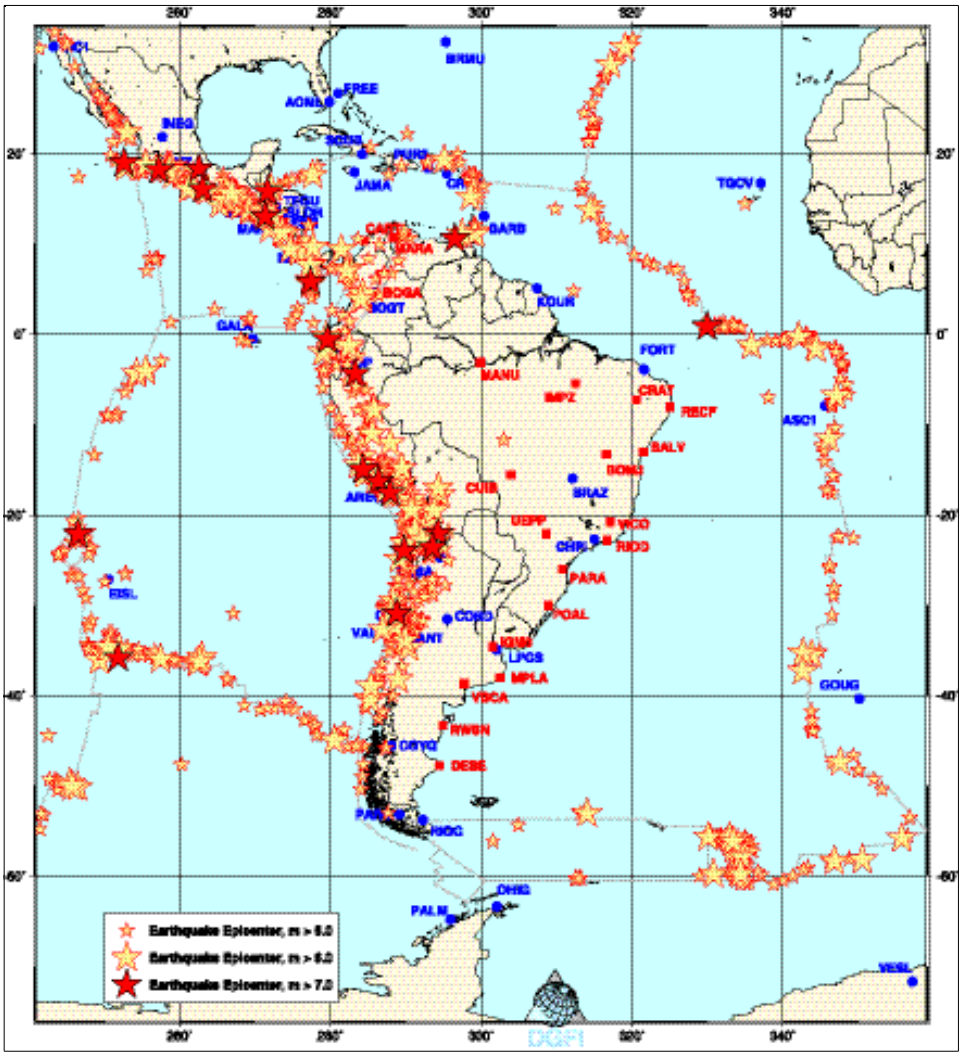

Figure 3: Earthquakes in the area of the IGS RNAAC SIR network from June 30, 1996 to end of Year 2001 (Source: USGS National Earthquake Information Center)

Four earthquakes were detected to cause significant station displacements. These are the earthquakes on January 13 and February 13, 2001 (m=7.6 and 6.5) in San Salvador (SSIA), and on June 23 and July 07, 2001 (m=8.4 and 7.6) in Arequipa (AREQ). The coseismic displacements at SSIA are 7 mm and 43 mm, respectively, for the two earthquakes, the displacements of AREQ are 520 mm and 43 mm, respectively (figure 4 and 5). For station AREQ also postseismic displacements were detected and determined (Kaniuth et al., 2002).

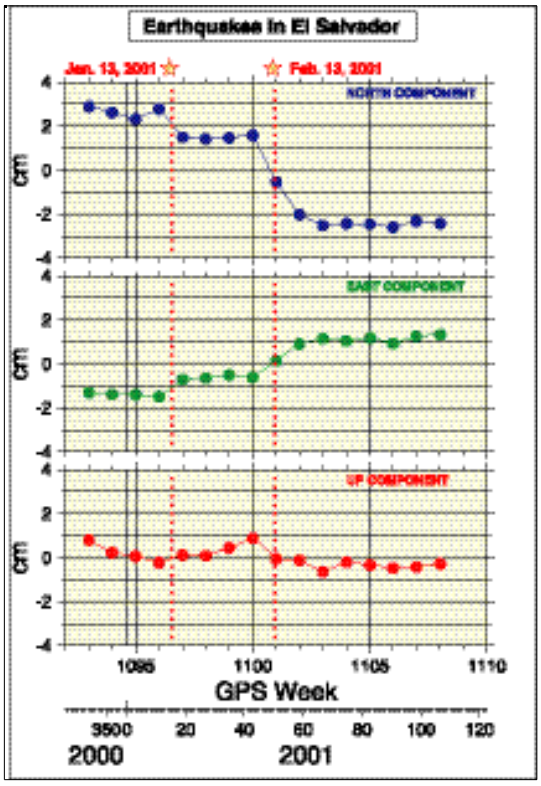

Fig. 4: Variations of station SSIA position components due to earthquakes in El Salvador (Seemüller et al., 2002).

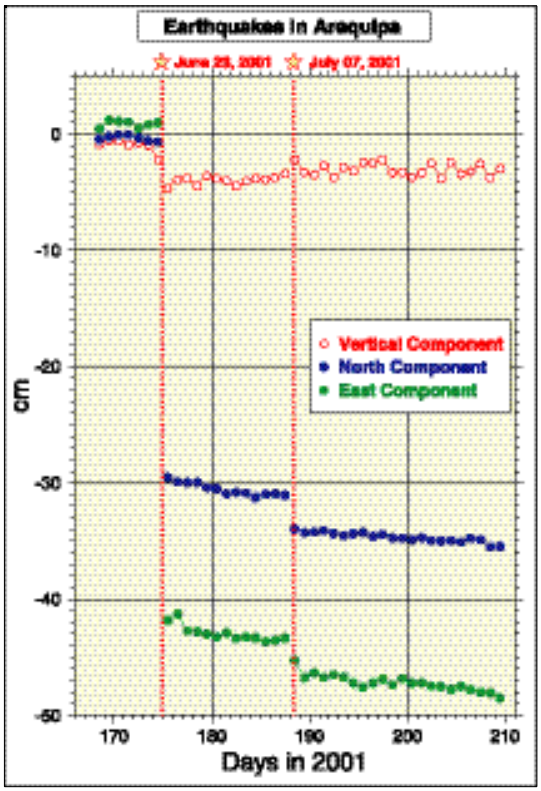

Fig. 5: Daily estimates of the AREQ position components in the reference frame realized by fiducial stations (Kaniuth et al., 2002).

Conclusion

For deriving station velocities it is necessary to pay attention to earthquakes nearby the stations, mainly in the vicinity of plate boundaries. Not to take in account the displacements of stations due to earthquakes would falsify the results of the velocity estimates. This further would have a corresponding influence on ITRF realizations and/or other global velocity determinations. The solution DGFI01P02 took care of the detected displacements in the stations SSIA and AREQ in 2001.

5 References

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USGS: United States Geological Service, National Earthquake Information Center (http://neic.usgs.gov/neis)